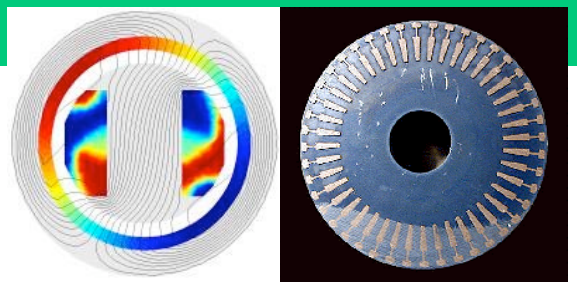
eceee'07 : Summer Study
4 - 9 June 2007, La Colle sur Loup, France

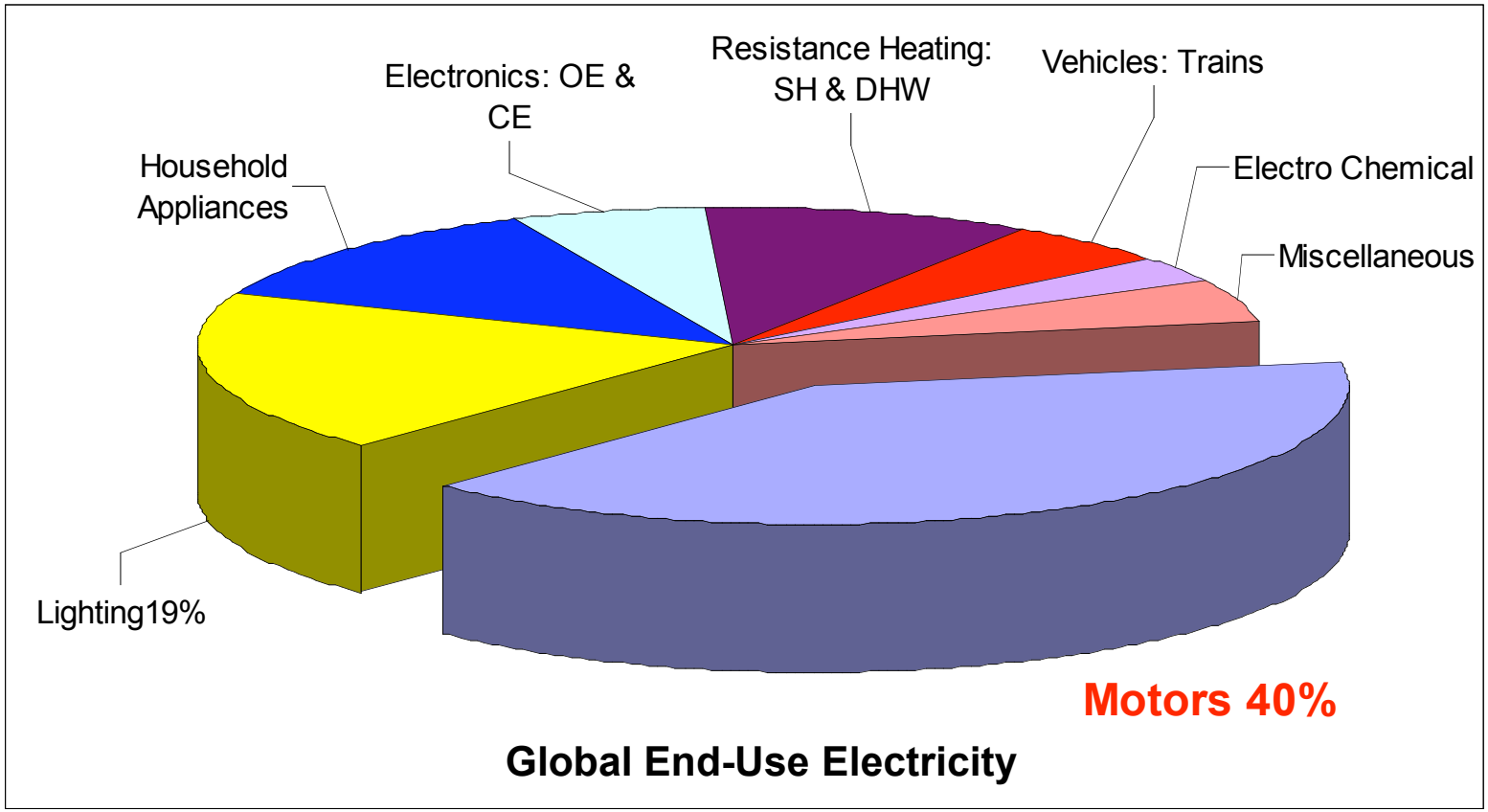
Efficient Electric Motor Systems:

Building a Worldwide Community of Practice

Conrad U. Brunner
A+B International, Sustainable Energy Advisors
Swiss Agency for Efficient Energy Use S.A.F.E.
Zurich/Switzerland

SEEM
Standards for Energy Efficiency of Electric Motor Systems



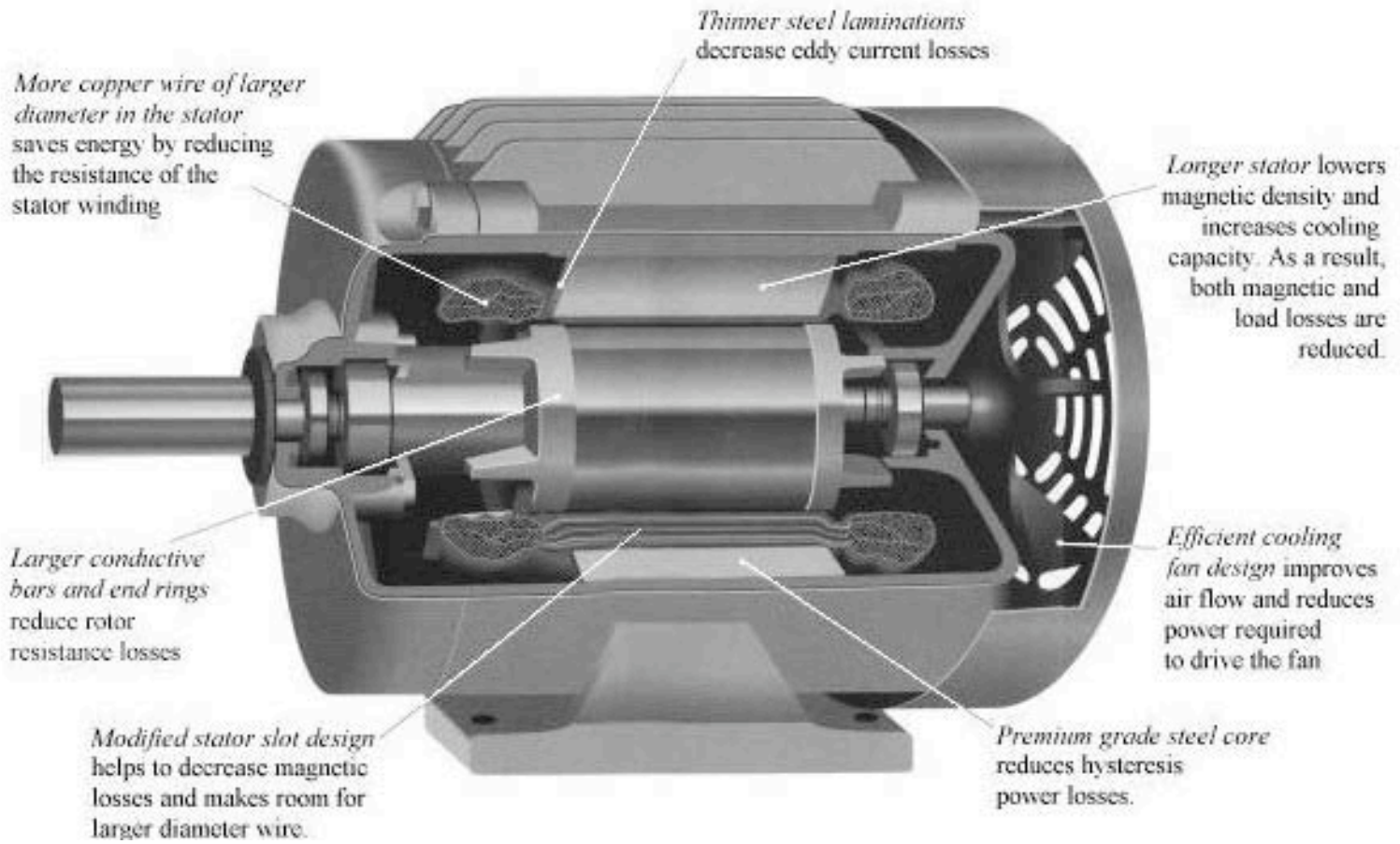


Conrad U. Brunner

Standards for Energy Efficiency of Electric Motor Systems

More efficient electric motors & systems

Source: MotorUp



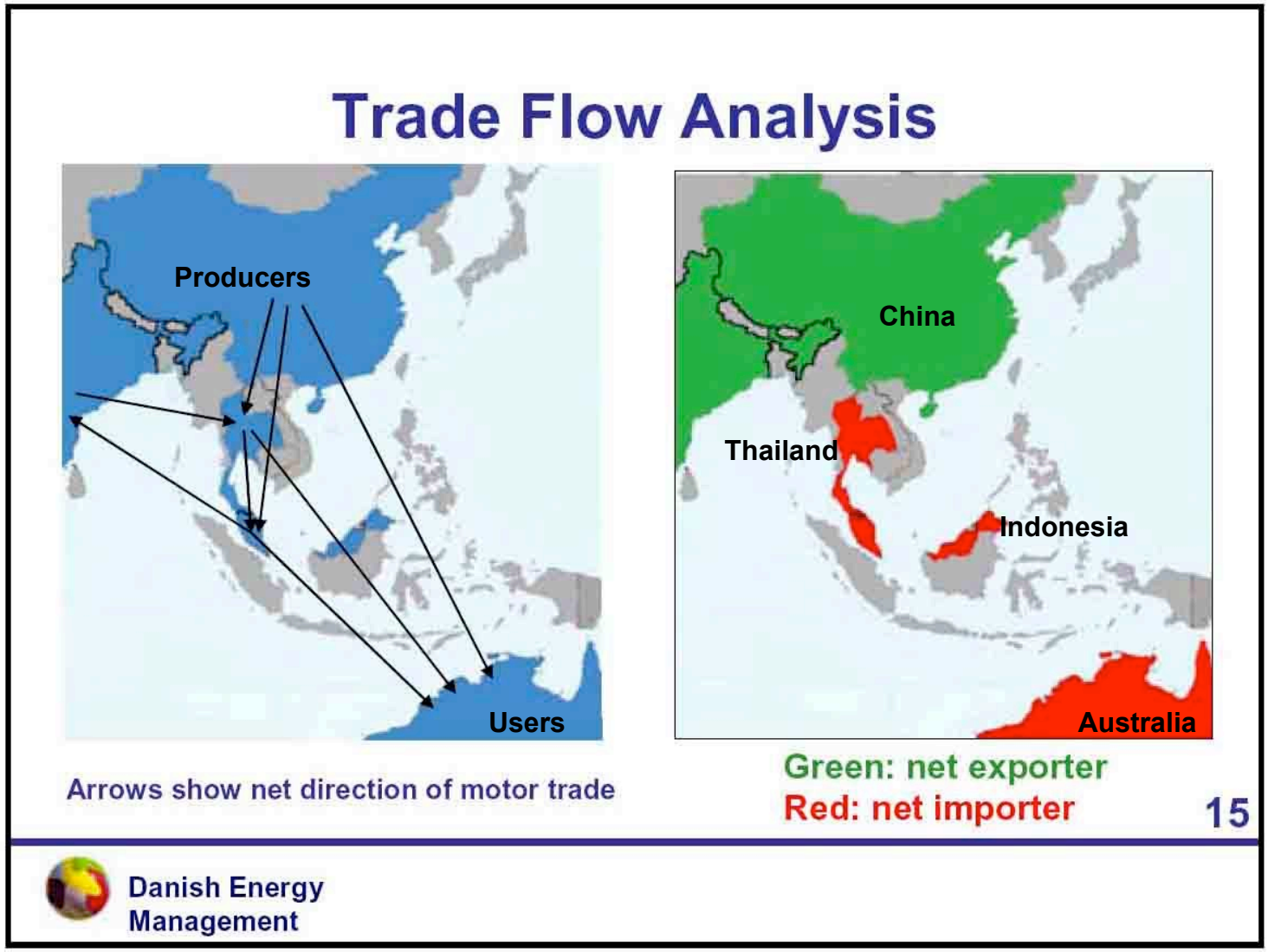
Electric Motors: 40% Electricity

- Pumps, fans, compressors, traction
- Industry and building technology, not household appliances
- Stock 300 million electric motor systems
- Sales 20 - 30 million new systems per year
- Repair 60 - 90 million old systems per year

- Electricity consumption 7‘400 TWh per year
- Electric peak load 1‘600 – 2‘300 GWe
- CO_2 emissions 4‘300 M t per year

- Energy savings potential 20% to 30%
- Energy cost savings 75 - 110 billion Euro per year

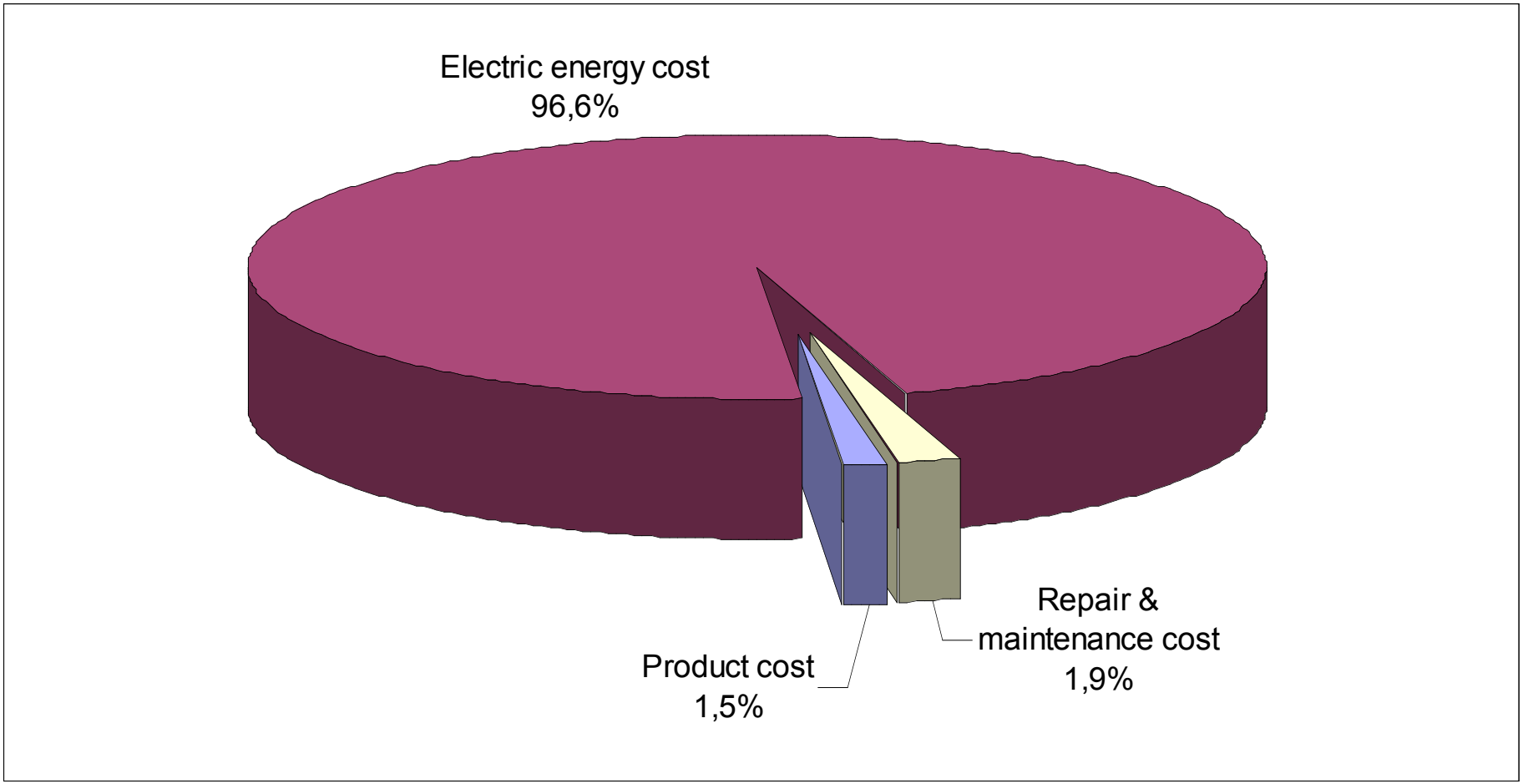
Harmonised Standards for Trade



Conrad U. Brunner

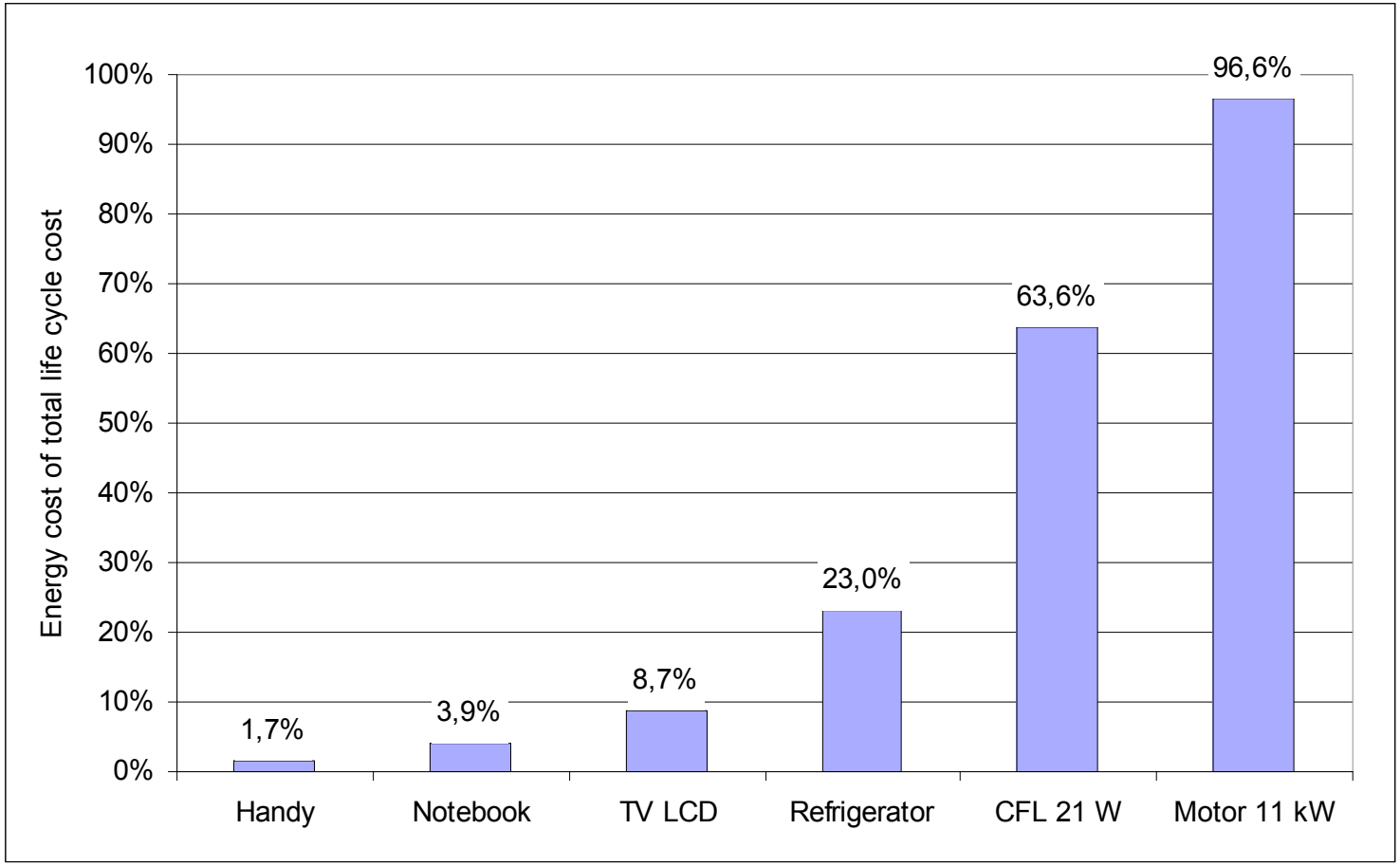
Standards for Energy Efficiency of Electric Motor Systems

Life Cycle Cost Motor



Conrad U. Brunner

Life Cycle Cost: Energy

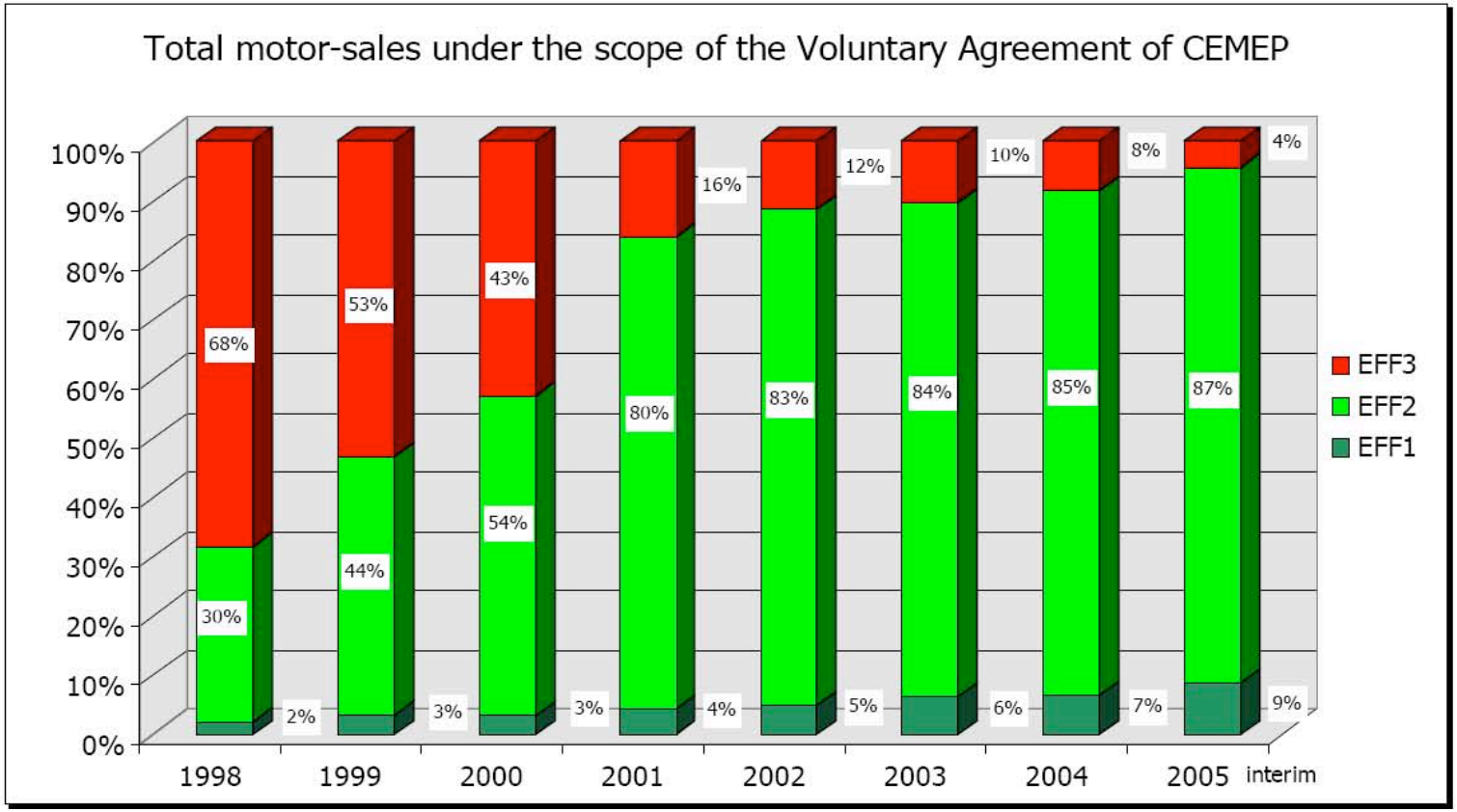


Standards for Energy Efficiency of Electric Motor Systems

Voluntary measures are too slow

Source: Cemep 2006/EuP 2006

market transformation and energy saved following the introduction of the CEMEP/EU agreement in the EU.



Conrad U. Brunner

Standards for Energy Efficiency of Electric Motor Systems

Electric Motors: Market shares 2005

Europe		
	CEMEP	non CEMEP
Eff 1	9%	7%
Eff 2	87%	66%
Eff 3	4%	27%

USA / Canada	
Premium	16%
EPAct	54%

Source: ICA 2005

Conrad U. Brunner

Standards for Energy Efficiency of Electric Motor Systems

Motor Systems

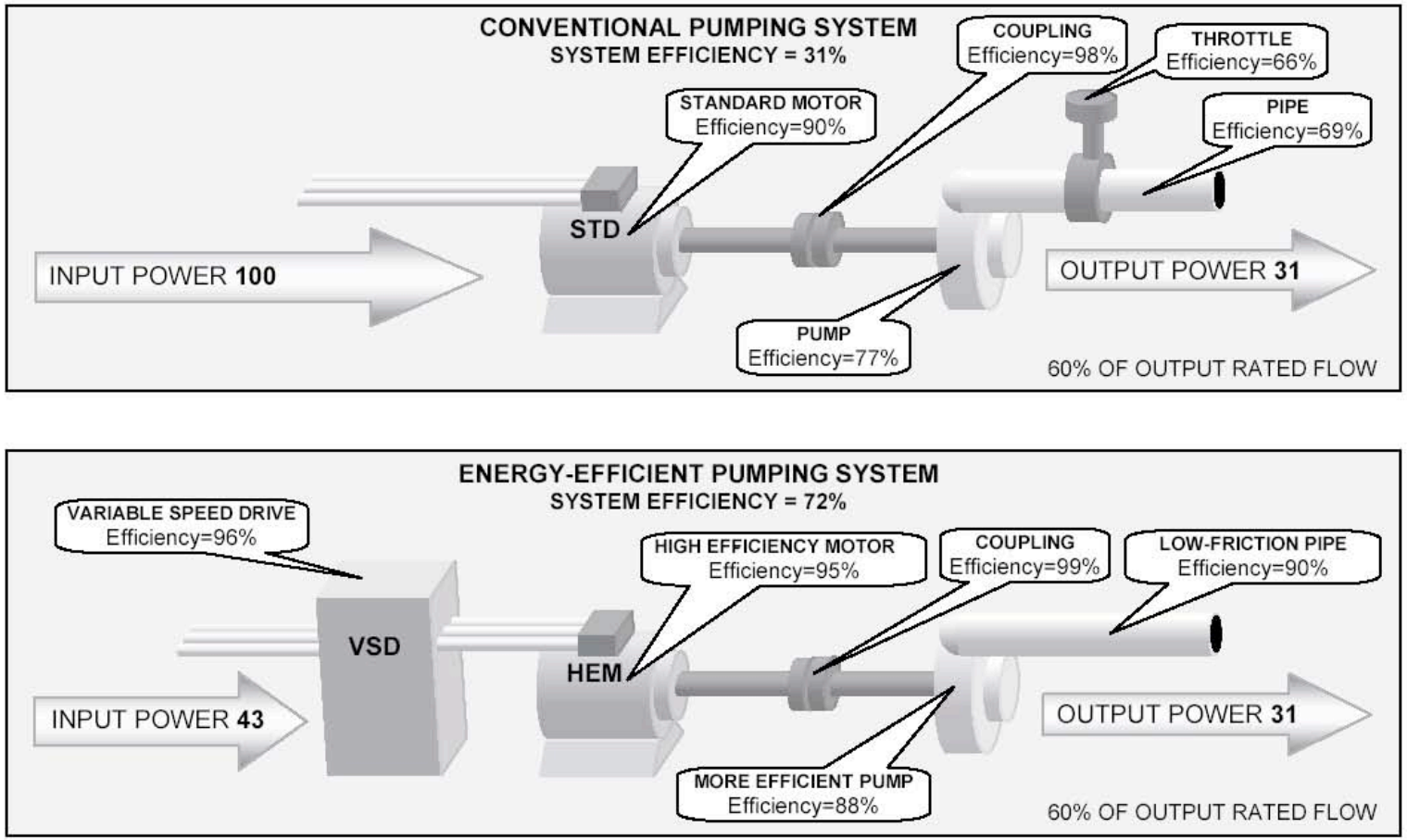


Figure 1 - a) Conventional pumping system (total efficiency = 31%)
b) Energy-efficient pumping system combining efficient technologies (total efficiency = 72%)

Conrad U. Brunner

Source: SAVE VSD Study 2001

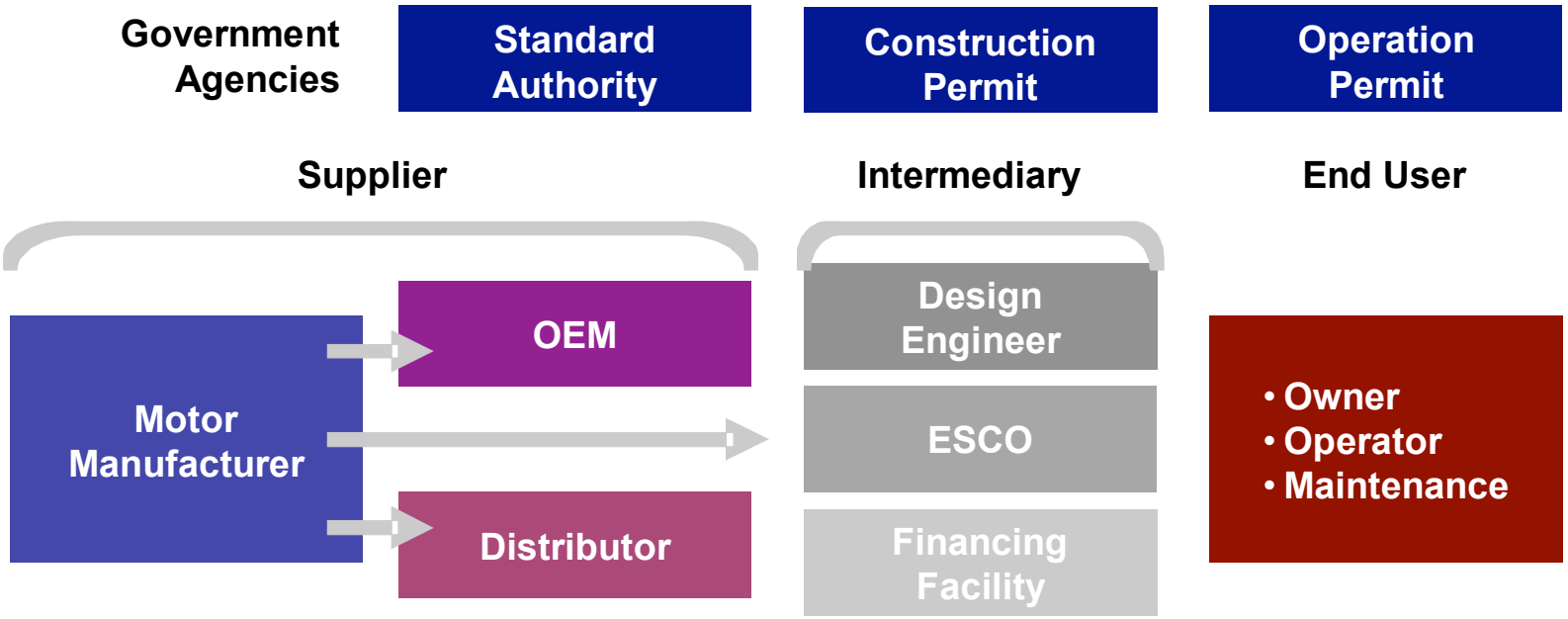
Standards for Energy Efficiency of Electric Motor Systems

Market transformation

Who has to agree to change?

- Producers ?
- Users ?
- Standard setters ?
- Governments ?
- Who else ?

Decisionmakers



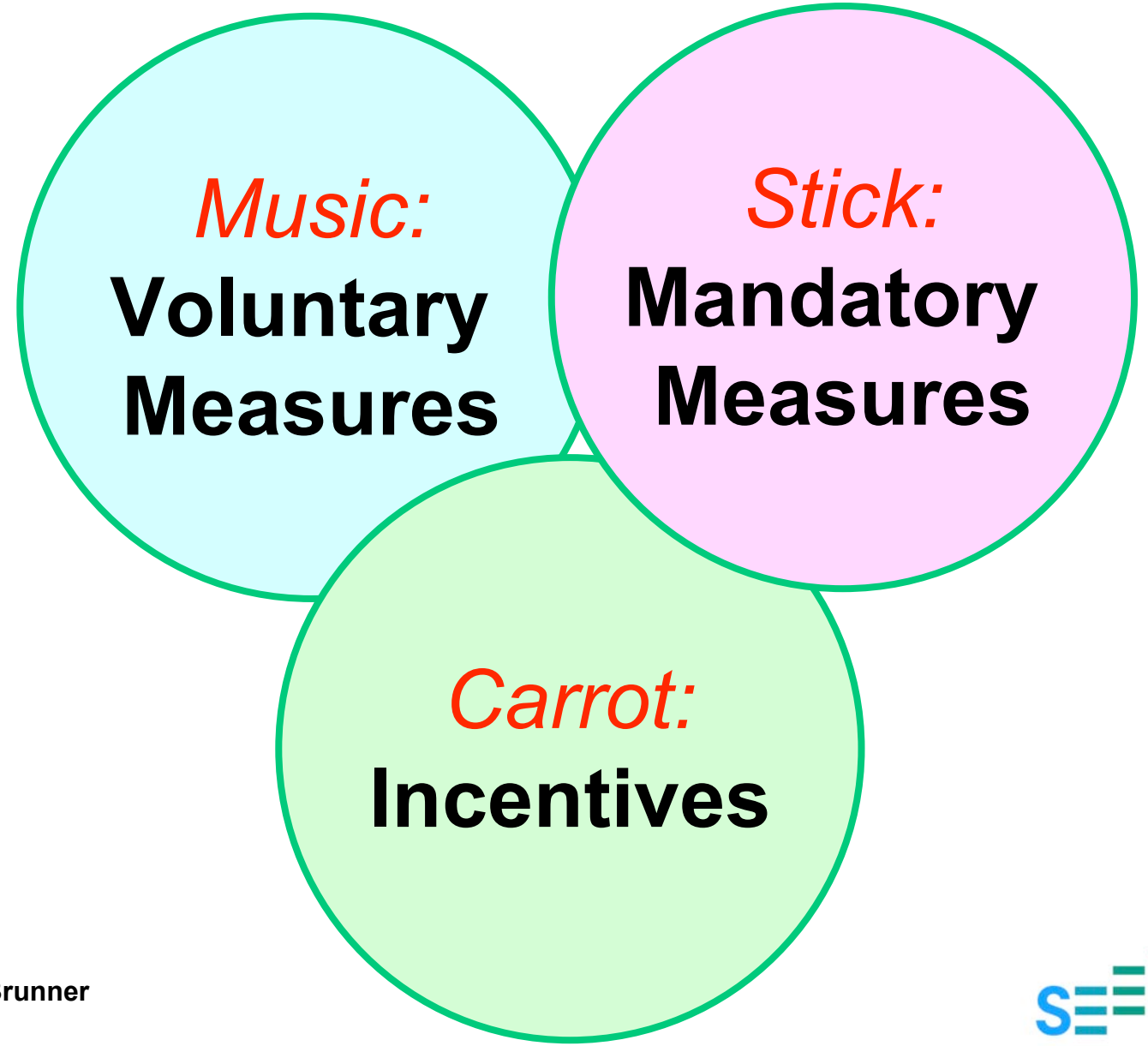
Barriers

- Knowledge not readily available
- Short range thinking – investment
- Everything works fine – why disruption?
- Higher initial cost
- Disarray of standards and labels
- Confusion about „silver bullet“
- Buried under industry benchmark
- OEM‘s not end-users
- International Trade

Chances

- Pay back in 1 to 3 years
- Harmonization of standards well under way
- New integrated technology is cheaper
- Know how is available: standard tools
- Financial incentives: CDM, loans
- International trade

How?


Music:
Voluntary Measures
Stick:
Mandatory Measures
Carrot:
Incentives

Measures

Voluntary Measures

- Labels
- Reach standards (future)
- Voluntary agreements with industry
- Public procurement programs
- Training & tools

Mandatory Measures

- Minimum Energy Performance Standards MEPS
- Enforcement: Compliance measurement, sanctions
- Standard product declaration and certification
- Independent testing

Incentives

- Loans (pay as you go)
- Tax rebate for investment
- Bonus / Malus
- CDM
- Government or utility subsidy
- Free audits

State of the Motor World

Summary Table by Economy

Yv = Yes, voluntary; Ym = Yes, mandatory; U = under consideration

Economy	Minimum Standard	Labeling	National Test Standard	Reference Test Standard
Australia	Ym(1)		AS 1359.102.1-1997 AS 1359.101-1997 AS/NZS 1359.102.3:2000	IEC 61972:2002
Brazil	Ym(1)	Ym(1) Yv(1)	RESP/004 NBR 5383/1:1999 (ABNT 1999)	
Canada	Ym(1)		CAN/CSA-C 390-98	CAN/CSA C390 CSA C 390-93
Chile	U(1)	U(1)		
China	Ym(1)	Yv(1)	GB/T 1032-1985 GB 755-2000	
Chinese Taipei	Ym(1)		CNS 14400	
Costa Rica	Ym(1)	Ym(1)		
EU Member Countries	Yv(1)			IEC 61972 IEC 60034-9
Israel	Ym(1)			
Malaysia	Yv(1)	U(1)		
Mexico	Ym(1)	Yv(1)	NOM-016-ENER-2002	
New Zealand	Ym(1)			
Republic of Korea		Yv(1)	KS C 4202-97 KSC 4203 KSC 4201	
Thailand	U(1)	Yv(1)	TIS 867-2532	
USA	Ym(1)		10 CFR Part 431 Subpart B App. A	
Viet Nam	U(1)		TCVN 2280-78	

Motor MEPS today:

- 10 countries
- 34% global population
- 47% global electricity

Conrad U. Brunner

Information on this page is jointly managed by APEC and CLASP.

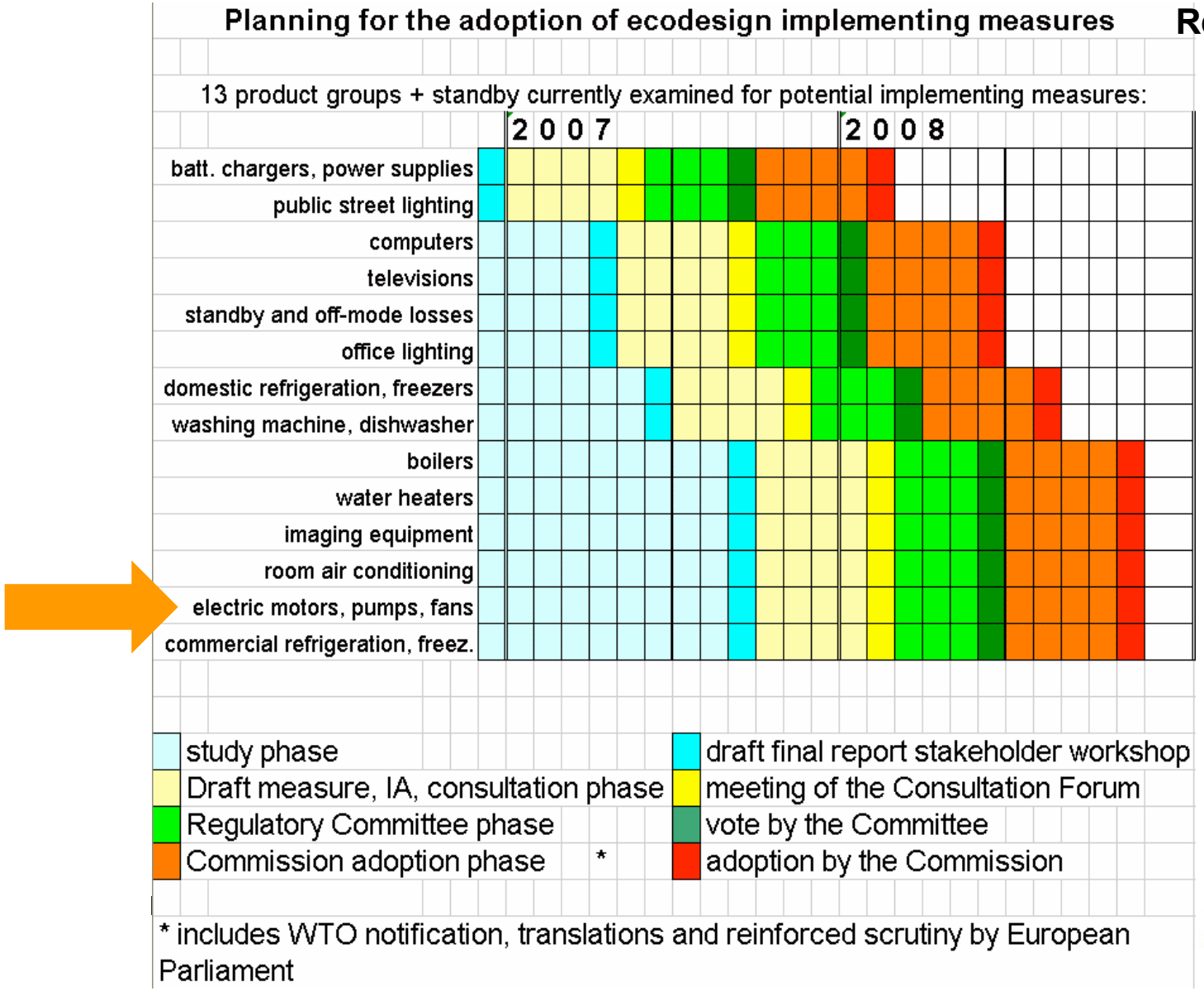
Standards for Energy Efficiency of Electric Motor Systems

New Developments

- IEA Implementing Agreement „Efficient Electrical End-Use Equipment“
- NEMA/ACEEE „Premium shall be MEPS within 3 years“
- ABB declares strategy for efficient motors and supports MEPS
- CECED: „Legislation is needed“
- EuP Eco-design will provide base for European MEPS by 2008
- UNEP/UNDP project for GEF SEEEM
- International standards
  - IEC 60034-30 Efficiency Classes by 2008
  - IEC 60034-2-1 Harmonized Testing by 2008
  - Testing for compliance with eh Star: Canada, China, IEC round robin
- ITFSP bases motors on SEEEM
- China, Korea, South Africa, India, Japan and Malaysia moving towards MEPS
- Clarification for CDM: small scale and programs

EU Action Plan: MEPS

Action Plan for Energy Efficiency: Realising the Potential



Standards for Energy Efficiency of Electric Motor Systems

Motors: New IEC Standards

- IEC 60034-2-1 (final draft 18 May 2007)
  Testing methods
  Stray load loss included:
  eh star good enough?

- IEC 60034-30 (second draft July 2007)
  Energy Efficiency Classes
  - New classification system **IE4/IE3/IE2/IE1**
  - Eff 1/Eff 2 adapted to additional losses
  - 50 Hz and 60 Hz treated equally

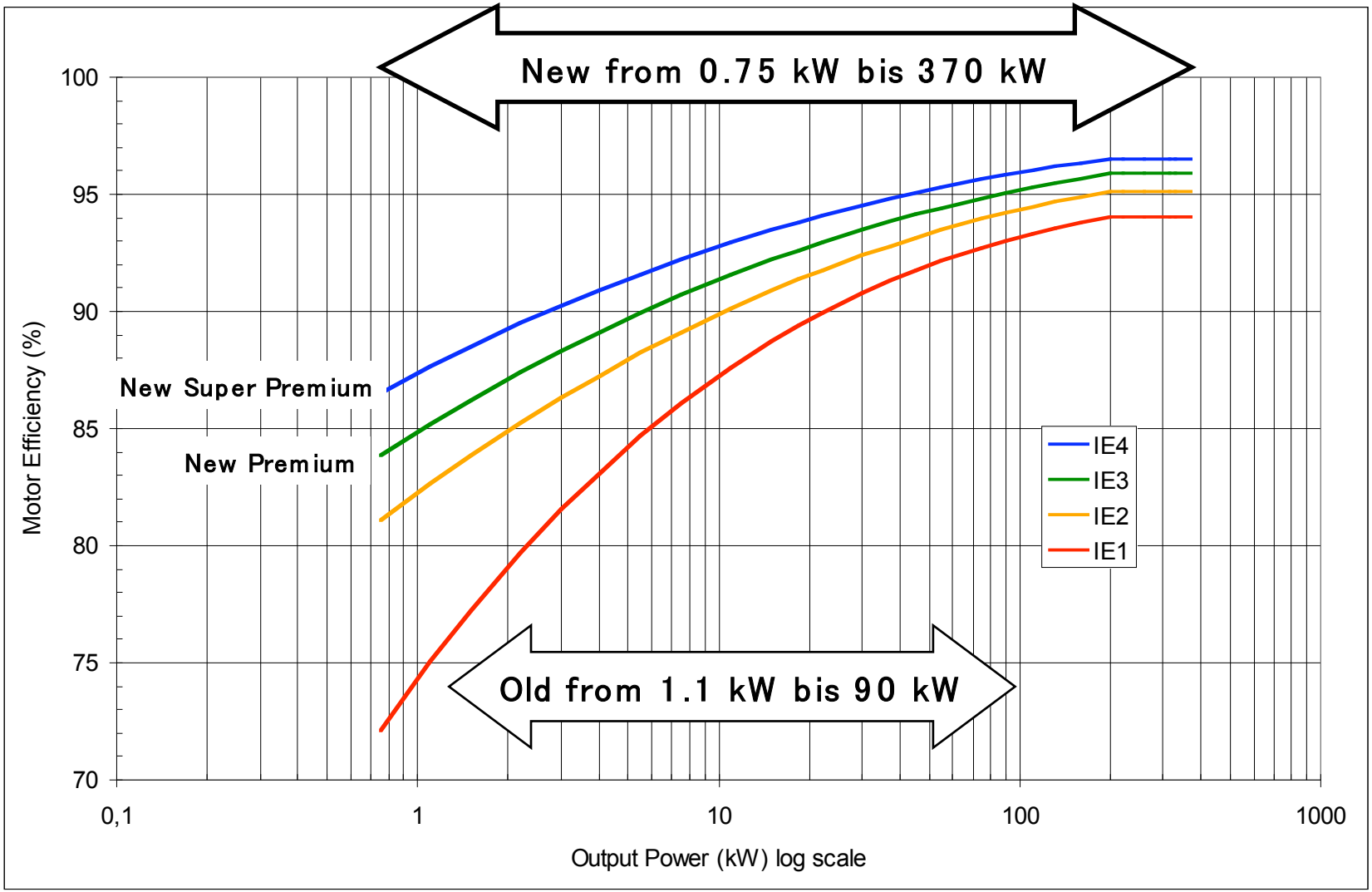
Harmonized Global Standards

Efficiency Levels	Efficiency Classes	Testing Standard	Performance Standard
	IEC 60034-30	IEC 60034-2-1	Mandatory
	Global 2008	incl. stray load losses 2008	Policy goal
Super Premium efficiency	IE4		
Premium efficiency	IE3		USA 2011
High efficiency	IE2		USA
			Canada
			Mexico
			Australia
			New Zealand
			Korea 2008
			Brazil 2009
			China 2010
			Europe 2011?
Standard	IE1		China
			Brazil
			Costa Rica
			Israel
			Taiwan

Conrad U. Brunner

Standards for Energy Efficiency of Electric Motor Systems

New IEC energy efficiency classes



Conrad U. Brunner

Standards for Energy Efficiency of Electric Motor Systems

SEEEM so far

Preparatory Phase (2005/06)

- September 2005 EEMODS'05 Heidelberg
  - Workshop invited by Paolo Bertoldi
- April 2006 New York
  - Technical Advisory Group

Implementation Phase I (2006/07)

- June 2006 EEDAL'06 London
  - SEEEM Launch: Community of Practice, Working groups
- April 2007 Motor Summit 2007 Zurich
  - SEEEM meeting: priorities second phase
- June 2007 EEMODS'07 Beijing
  - SEEEM meeting: define work for second phase

SEEEM Standards for Energy Efficiency of Electric Motor Systems

SEEEM next phase 2007/08

- Organization
  - Strengthen global reach
  - Cooperate with international organizations and projects:
    - EuP Ecodesign
    - IEC Standards
    - ITFSP
    - IEA IA
    - UNDP/UNEP GEF
    - CLASP
    - APP
  - Secure sustainable funding

- Goal
  - More countries with MEPS at IE3 level: **70% of electricity**
  - Industrialized **plus** developing countries

Work plan phase II 2007/08

- Inform on new global standards & labels
- Build database global market & energy: Topten Motors
- Road map for policy development:
  - Share front runner experience
  - Target key economies and manufacturers
  - Stimulate incentive programs
  - Pool tools, guides for best practice
  - Expand network of independent testing facilities
- Promote technology for super high efficient systems (standards needed?)
- Start concept for integrated motor systems: pumps, fans, compressors

SEEEM Community of Practice

SenterNovem
Agentschap voor duurzaamheid en innovatie

Natural Resources Canada
Ressources naturelles Canada

COPPER INFO

CLASP

UNDP

IIEC

SEEEM Steering Committee
Anibal de Almeida, University of Coimbra, Coimbra, Portugal
Chris Baker, Defra, UK
Paolo Bertoldi, EC JRC Ispra, Italy
Robert B. Boteler, NEMA/Emerson, Gallatin MO, USA
Shane Holt, Australian Greenhouse Office, Sydney, Australia
Benoit Lebot, UNDP/GEF, Paris, France
Aixian LI, CNIS, Beijing, China
John Malinowski, Baldor, Fort Smith AR, USA
John Mollet, ICA and Clasp, New York NY, USA
Steven Nadel, ACEEE, Washington DC, USA
George Alves Soares, Eletrobras, Rio de Janeiro, Brasil

Technical Advisory Group
Austin Bonnett, independent consultant, USA
Anibal de Almeida, Professor, University of Coimbra, Portugal
Qin He, Professor, Shanghai Electrical Apparatus Research Institute, China (supported by Xin Zhang, China National Institute of Standardization, China)
Brenton Watkins, independent consultant / Chair EL 14 Standards Committee, Australia

Australian Government
Department of the Environment and Heritage
Australian Greenhouse Office

AUSTRIAN ENERGY AGENCY

UNION OF THE ELECTRICITY INDUSTRY
eurelectric

CNIS

भारतीय प्रौद्योगिकी संस्थान दिल्ली
Indian Institute of Technology Delhi

MARKET TRANSFORMATION PROGRAMME
Supporting UK Government policy on sustainable products

A+B International
A+B 国际

Electricity Commission

[S · A · F · E]

swiss energy

Umwelt Bundes Amt
für Mensch und Umwelt

SEEEM
Standards for Energy Efficiency of Electric Motor Systems

Thank you !

www.seeem.org

www.energy-efficiency.ch

www.swiss-energy.ch

Conrad U. Brunner,

Gessnerallee 38a, CH 8001
Zurich/Switzerland

cub@ABinternational.ch

Tel +4144 226 30 70 Fax +4144 226 30 99

Conrad U. Brunner

swissenergy

A+B International
A+B 国际

[S · A · F · E]

SEEEM
Standards for Energy Efficiency of Electric Motor Systems